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ABSTRACT

Rural schools often have difficulty in developing and implementing a 21st century, K-12 technology plan. This report describes one rural school district's (Wayne, Nebraska) successful efforts at technology integration. It discusses the efforts of installing 25 networked computers in the local high school, linking buildings with fiber-optic cables, automating the middle school library, and creating a distance education program by upgrading software and hardware to link the schools to the community via the Internet. The report reveals that rural schools can succeed in integrating technology into the curriculum, but it takes a united effort combined with the rural districts' willingness to seek help from regional and state agencies. (GR)

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Applications of Technology in Rural School Facilities

THE CONCERNS FACING TECHNOLOGY INTEGRATION

The implementation of technology applications in rural schools is hampered by circumstances similar to urban schools with some unique differences. Urban districts suffer from insufficient funding to properly integrate technology into the classroom (*properly* means having a computer ratio of 3 students to 1 pc, having every pc linked to a network with Internet capability, AND being able to afford software and appropriate training provided by a capable network support staff). Urban centers suffer from a high turn-over of network coordinators to private business since they cannot compete with the high salaries and stock options offered. However, with larger property values than rural districts, generally, and with the potential of finding knowledgeable technology coordinators and pc repair staff, urban schools have more resources at hand. Larger districts have a business community that may include computer services that could be contracted to support the network. There also may be a community or state college within the borders of more urban districts than rural and typically college faculty are very willing to offer their advice.

Rural districts do not have resources in the community to help train staff and assemble complicated networks. With small schools, there is usually a willing faculty member with an interest in computers wanting to act as a part-time network coordinator, but lacks classroom training and networking experience. Further, when this one or two hour a day technology coordinator/math teacher is sent to a one or two day seminar on how to build a network, there is so much information offered in such a small amount of time that it is improbable the lessons learned can be applied successfully.

This situation usually results in a rural school offering computer services to the students based on the choice and bias of an ill-prepared, part-time technology coordinator. If the coordinator is exceptional, has no family, or life outside the school so journals can be constantly reviewed and contacts made outside the

district to gauge local services to industry use and demand, the technology represented in the district may be on target with what skills the graduates need to compete in an ever-increasingly complex and techno-demanding world. Often, however, rural schools falter in their attempts to develop and implement a 21st century, K-12 technology plan due to not having (or attempting to find) trained and experienced human resources. If a rural community is fortunate in having a computer-whiz residing within the district, then the whiz would have to be willing to work for a quarter or half of the salary available in the private arena. Also, most state certification departments allow non-certified, technology staff to train teachers but not students which is another factor baring more preparation for future graduates.

Rural schools have trouble attempting to partner with corporations due to not being able to offer much return benefit to the business ally. There are national and international firms willing to offer software, hardware, or money for specific 'company interest' projects. Generally, however, corporations want high efficiency which can most easily be shown by serving high population areas (low investment/high return). Rural districts cannot compete with urban schools in this arena simply because of low enrollments. In competing for grant dollars, rural schools are also at a disadvantage because each staff member, from administration to faculty, is having to wear two or three 'hats' (duty assignments) and do not have the time or experience to write a successful grant application.

Infusing technology in rural pubic education today suffers from a timing problem. Many administrators completed their educational administration programs during a period when either there was no emphasis in computer applications or there were no computers used in the college or university administrative preparation programs.

Since the early 70's, there has been more effort by colleges to bring the computer curriculum into the educational administration program, but the rate of change from basing computer training on the main frame concept to the pc-based network has been very slow. These programs must be updated to better serve potential administrators and students of the future.

Administrators cannot be experts in every aspect of school curriculum, but if there were no 'hands-on' experiences for administrators in their academic preparation and if they had little interest in the area of technology, the natural result will be a school district or building with a lack of emphasis in technology and little direction for future applications. Rural schools suffer more from this dilemma since there may be only one or two administrators in the district and depend more on their leadership. In urban districts, there are more administrators and the likelihood of someone having more technical experience is increased. Because of this lack of preparation, the 'timing problem' for the students advancing through schools today will result in being detrimental in their vocation choices in the future. Further, once schools finally begin producing technically literate graduates, the students will still be on the low-end of the knowledge curve and business will still be frustrated with new employees. This knowledge gap and technical education preparation discrepancy may take years (decades) to reduce. Business in general is not satisfied with the caliber and abilities of high school graduates in technology and, because of this dissatisfaction, transfer blame and criticism to other curricular areas of perceived lack luster performance.

There may be a few educators still resisting using technology in the classroom and refusing to believe that children need a good background in this area—'back to the basics' in some minds may exclude the use of a computer or using the Internet for research. Infusing technology in the classroom may also be understood by educators in various ways; one educator may feel that word-processing is 'infusion', while another may not be using a text in geography and basing all instruction from Internet research. Another difficulty facing the infusion of technology in rural schools in America is the large minority of teachers reaching the retirement age bracket. The 'baby-boomer' generation is advancing toward early retirement and some in this group may not be willing to change classroom strategies to include technology enhancements due to having to take the time to learn a new skill.

With no district plan of integrating technology into the classroom and with no procedural staff development efforts in technology 'enforced' (there should be no choice), the use of hardware and software in the classroom to improve learning and open the walls of education to the world—WILL NOT HAPPEN. Additionally, if the staff development activities are not consistently implemented, focused with articulation, and have district-wide standards of

achievement for teachers and students, then the technology services offered the students will become repetitive and redundant. Students will be inclined to learn more about technology on their own—and this search for them could be a good experience—but there is risk involved without guidance. The district must support the idea of training the staff to implement technology into the classroom. The term 'support' means more than just verbal acknowledgment; there must be a significant financial commitment to the technical training activities.

ONE RURAL SCHOOL'S ATTEMPT AT TECHNOLOGY INTEGRATION

Traditional school district boundaries, concepts and clients are no longer the dominate paradigm in Wayne, Nebraska –an American heartland. Through a unique collaborative effort, the scope of the district's curriculum now includes the world. The community effort is fired by contributions from Wayne State College, Wayne Community Schools, Wayne Chamber of Commerce, Wayne City Council, the mayor, private businesses, federal and state agencies, and especially from the students themselves.1

The payoff is a powerful technological foundation that has enabled the district to offer services such as e-mail, graphical search mechanisms, fiber-optic speed, audio/video online capabilities, "take-home" computers, public library access to the Internet, staff training on curriculum and technology integration, automated libraries, automated school lunch program, central office tele-computing, tech-prep curriculum and much more. The most impressive aspect of the Wayne Community project, however, is its time span. In just three years, a rural school district in a town of 5,000 people was able to develop a multi-faceted technology service with over 330 networked workstations for 950 students -- beginning with $50,000 and the existing 26 Apple IIe's in 1992.

Back in the Beginning

The motivation for moving the district in the direction of being a regional leader in technology began with its school board. At a regular meeting in the fall of 1991, a state review committee reported a lack of hardware and software use

1. Jensen, Dennis, Ed.D. "Rural District's Partnerships Bear Fruit in Three Years." T.H.E. Journal (10/96) : 69-71.

throughout the district. The panel recommended serious attention be directed at creating opportunities for students to learn about technology.

In 1992, the superintendent organized a city-wide technology committee. They were to: set a technology vision for the district; establish goals in curriculum scope and sequence; evaluate software and hardware needs in every field and student service area; and, develop a timetable with which to measure status and success. Committee members were representatives of private business, Wayne Chamber of Commerce, Wayne State College, Nebraska Department of Education and the school district.

They met throughout the summer and in the fall of 1992 gave a comprehensive program recommendation to the Board of Education at a meeting in October.

Initial Steps

Among the recommendations were:

- A 3:1 ratio of students to computers;
- A K-12 computer curriculum (separate from other fields);
- Industrial arts to industrial technology restructuring;
- Automation of the district's three libraries;
- Distance education development;
- A networked computer lab; and
- A hardware purchasing plan focusing on IBM-compatible workstations.

After approving the recommendations, the district was off and running. The board earmarked $50,000 in 1992 for seed money for costs of the initial stages. Combined with general fund dollars (the total district budget in 1992 was just over $4 million), the board's investment grew to $75,000 and specifications were drawn for a 25-station computer lab in the high school to replace the typing room. During the bidding process to build the lab, Dennis Linster, director of Network Services with Wayne State College, shared his idea with the superintendent. Linster asked him to hold any bid openings until he could arrange for a summer-session class for graduate students entitled "The Wayne

High Computer Lab." The course's objectives were to design, implement and install the high school's computer lab. This initial involvement of the college opened the doors to an unparalleled relationship between the school district and college that continues today.

Past the Basics: What Next?

By August of 1993, the district had 25 networked computers installed in the new computer lab with a central server located in the high school's library connected via a 16 mbit Token Ring network. The cost savings enjoyed by the district was phenomenal -- because graduate students completed the physical labor -- estimates in savings ranged from $12,000 to $25,000. Participating graduate students benefited from the experience and transferred the knowledge back to their own districts. Although the computer lab represented a monumental step for the district, it was only the beginning of a collaborative atmosphere that blossomed. As the lab neared completion, the Board of Education wrestled with a new school budget. From the funds not spent the previous year, they transferred $101,000 into the new Technology Fund.

> Cost savings to build the lab were phenomenal because graduate students completed the physical labor; estimates in savings ranged from $12,000 to $25,000.

The district retained its focus on the technology plan adopted in 1992 and began the following projects:

- Automating the middle and high school libraries;
- Building a tech lab in the industrial arts area of the middle school;
- Fully computerizing the central office and bookkeeping system;
- Expanding the Token Ring network in the high school and adding computers;
- Adding a CD-ROM tower to network;
- Providing training for staff on the network and Internet-access instruction;
- Automating a lunch ticket accounting system; and Implementing a distance education system in the middle and high schools with donations from Wayne State College and private businesses in Wayne.

As the system grew, the college was a constant resource for project development and design. Since the size of the system was becoming taxing on available volunteer time, Linster recommended the district consider the services of a talented college student majoring in computer systems operation. Mike Eckhoff, a Wayne High graduate in 1993 and a college freshman, became the primary supervisor of the technology implementation plan. A high school senior, Trevor Schroeder, became Eckhoff's assistant. The district hired Eckhoff on a part-time basis to be technology director. Schroeder continued to donate his time to the district in order to gain first-hand experience in network operations.

Distance Education Activities

A distance education project started in the fall of 1993 with financial support from Wayne businesses and from Wayne State College Foundation. The project's goal was to embellish the high school Spanish III course by having a two-way, audio/data/ video link in real time with a school in Juarez, Mexico. The distance education mode chosen was a simple telephone line connected to a computer, a VCR camera and a speaker, allowing an interactive course to be team taught between two sites.

Faculty training was provided by TSN, Inc. in Boiling Springs, Pa. and by the Pennsylvania Department of Education on the campus of Wayne State College and at Wayne High School. Teachers from Wayne were furnished with training as were teachers from Juarez and Cancun, Mexico. The distance education failed due to problems in Mexico, but a second undertaking was started in the middle school with grades 6-8 using videophones attached with schools in Japan.

In March of 1994, a third distance education activity began with funding from the National Science Foundation and leadership contributed by the Nebraska Department of Education, Division of Technology. Through the guidance and assistance of then-director Melodee Landis, the just-released Windows version of CU-SeeMe software (developed by Cornell University) was tested as a beta project in Nebraska between the Wayne and Omaha North High Schools. The project had technical problems initially. But in further tests, the DOS version of CU-SeeMe worked well for site-to-site distance education applications.

The benefit Wayne schools reaped from the distance education project grants was hardware and software allowing simultaneous access to Internet from all networked workstations. The district remains actively involved in pursuing distance education projects, especially those using the Internet as the connecting link. Spanish instruction is still provided through a satellite downlink for grades K-3. (The district has benefited most recently from a TIIAP or Department of Commerce grant to establish an 'Anytime, Anywhere, Anyplace Distance Delivery System with archiving video and audio.)

A "Lighthouse" District Shines

In the summer of 1994, the district was chosen to receive a $91,000 award from U.S. West. This regional telephone company sought school districts committed to technology for the purpose of developing "lighthouses" to serve as models throughout the state of Nebraska.

The award was directed to the 1992 technology plan and, with various installations, enabled the district to:

- Bolster the number of K-8 workstations;
- Network both middle and elementary schools to the Wayne campus with Ethernet and Token Ring topologies;
- Create a network topography for possible ATM applications in the future;
- Purchase 20 laptop computers for fourth graders to take home and use for assignments.

The Board of Education, in the summer of 1994, also earmarked $60,000 for computer technology needs in K-12. Additionally, the board had the foresight to permit the high school Industrial Arts department to convert to a tech-prep lab with funds provided through a lease-purchase program.

The principle reason for the board's interest in restructuring the Industrial Arts curriculum relates back to a 1991 NCA/state department review. The report indicated only 8% of students participated in the Industrial Arts program, while 28% of the high school's total facility space, as well as two full-time instructors, were devoted to it.

As a result of the newly implemented tech-prep program (and the positive influence of other factors such as faculty support of curriculum change), the 1995 student enrollment in the Industrial Arts program was about 37% of the high school student body.

Finally, the fall of 1994 saw:

1. Fiber-optic cable linking the buildings on the Wayne campus together -- all networked computers are driven by a Novell server and a Linux machine for e-mail and Web publishing, which are located in the high school library;
2. The middle school library automated;
3. A staff development program instituted by the building principals allowing substitute teachers to be hired for staff training on technology applications during the school day;
4. Training on WordPerfect 6.0a for the high school business teacher, Sharyn Paige, in Omaha, Neb., with funding provided through Northeast Technology Community College in Norfolk, Neb.;
5. A networked computer in the teachers' professional library in the high school (a gift from Complete Computers, a local business in Wayne, Neb.);
6. Battery back-up system and network support technology provided through a gift from Wayne State College;
7. Established an audio/visual laboratory for students to develop commercial-quality video productions like animated cartoons; digitizing video equipment; morphing capabilities; video and audio editing equipment are all networked to the central Novell file server in the Art department;
8. Have 250 workstations networked to servers in the high school library from three different buildings in Wayne; and
9. Have own Linux server for assigning e-mail addresses.

Since March of 1994, the district has enjoyed frame-relay access to the Internet. Nebraska was one of very few states that supported such a statewide network for the purpose of enabling students with Internet searching opportunities. The Wayne district was one of the first to have classroom-based access to the Internet.

WayNET Adds Links to Community[2]

The Chamber of Commerce and the city were curious about the Internet. How could access to it provide benefits for rural economic development and community growth?

The Chamber established a strategic planning committee to study providing access to the city. Over an 18-month span, committee members administered a community survey on computer use at home; they held several informational meetings at various sites; they sponsored speakers on other communities' Internet experiences. Finally, they submitted a grant to the state department of Rural and Economic Development in the area of telecommunications and were successful in receiving $2,500.

These grant dollars were used to begin developing a new community service entitled WayNET. Its purpose is to offer Internet opportunities to all citizens of Wayne, Neb. WayNET is administered by a committee composed of the mayor, city administrator, network services director with Wayne State College,
Educational Service Unit technology director, the technology director with Wayne Community Schools, and the school superintendent.

In September of 1995, the city council directed $14,000 to the WayNET project, which was applied to expanding the telecommunication services of the school district. With 16 remote-access lines connected to a T1 line within the Nebraska
frame-relay system, patrons living in Wayne can search the Internet at their leisure. The school district's technology team trains all interested community people on how to access the remote system using the computer lab in the high school. This remote-access course is offered through an adult education class, a function of the extension services of Northeast Community College, in Norfolk, Neb. Instruction is provided by Wayne State College and Wayne High School students, who are paid for their services by Northeast Community College. Participants in adult-education classes are given access to the high school's remote telecommunications system for an indefinite period of time for only the cost of the class registration.

2. Jensen, Dennis, Ed.D. "Waynet: A School Internet Service to the Community." From Now On, Online Technology Journal, Editor, Jamie McKenzie. May, 1996. Www.fromnowon.org.

The district operates an elementary school in Carroll, Neb. (14 miles from the central server) and is in the process of installing eight remote lines for K-4 elementary Internet access, bringing the total community access lines to 24. This Internet access is a collaborative effort involving a state college, a community college, a state agency, a city council, a local chamber of commerce, a special education service agency (ESU), city administration, college and high school students, and a local school district. These agencies are working together for the purpose of efficiently providing a service to the public that would be difficult to replicate at such a reduced cost by any one member entity alone.

Fortunate, But Also Smart

The community of Wayne has been extremely fortunate. It has had the right people in the right places at the right time as it developed technological services for its children and the broader community. A critical factor in the success of the overall project is the cooperation of the faculty and staff of the Wayne Community School District. The faculty yearned to bring in as much technology integration as money would allow and they were eager to learn. The district also benefited in the training of its staff by being able to use students from the college and consult with college administration on implementation issues. Without the willingness and support for technology improvement from the faculty and staff, the project would not have enjoyed such success.

Rural schools can succeed in integrating technology into the curriculum, but it takes a united effort of most every agency in the community. Rural districts also have to seek help from regional and state agencies—there is financial support available for rural districts if someone in a leadership position is dedicated and committed to seek funding. Once the funding is secure, then human resources can be sought.

In Wayne's success story, it is important to note that it was exciting to be part of putting it all together, but in the area of technology, the job is never done. When the 1997 school year began without a new plan of implementation and a new network director, network growth began to stagnate.

A new technology committee was not formed until January of 1998 and the district began experiencing problems trying to maintain such a large network with so little labor support. Machines also became outdated—especially those purchased in 1992 and a plan had to implemented to replace and transfer older machines to lower use areas. The Industrial Technology area had to have pc's replaced and the old server had to be replaced and the operating software updated. Many original machines had been purchased without harddrives since all the software was stored on the main server—this resulted in causing a problem with broadcasting CDROM programs. There are constant problems in a large network that need continual attention. Once the network is operational and the system seems efficient, just wait awhile, and it will call for help. Planning, planning, and more planning is a requirement.[3]

Boards of education, administrators, and teaching staff MUST realize and accept that computers and ever-changing technologies are an integral part of the school curriculum today and will play an even more significant role in K-12 education in the future. Many in education have indicated that computers and technology integration is a tool for the instructor to use to better enable students to learn. This is true. However, the bulk of the literature pertaining to career opportunities of today suggest that of the approximate 600,000 job openings currently advertised, 450,000 are related to technology and knowledge of computer applications. Therefore, using technology as a tool to improve teaching and learning is a critical need in schools, but crucial to being employed in the future is knowing how to use advanced technology in a useful way. Since teachers are mainly the first point of contact for students in schools and not the technology director, then teachers need to be in agreement as to the importance of technology as part of every day instruction and in making every effort to stay current with technologies used in the corporate and military world. For every advanced technical experience the school can provide, the students will reap the benefits in whatever comes after graduation. This means having an outdated Apple IIe or an old XT PC in a classroom is NOT benefiting the students—just as having a social studies textbook end with the year 1967 is doing an injustice to children, so is having a 16 year-old computer in the classroom. The implication in this instance is to urge all schools to reconsider the priorities in the school budget and to finally come to the realization that JUST HAVING ANY COMPUTER IN THE CLASSROOM does not justify a school being called 'technologically advanced'.

3. Jensen, Dennis, Ed.D. "Case Study on Technology Development", pgs. 112 to 114. Teaching in the Computerized Classroom. Second Edition, McGraw Hill, 1997

Considering the school budget, it is often blamed as the culprit for not having technology in classrooms. This excuse is a poor one. Budgets are created by people—by administrators, superintendents, principals, central office staff, and faculty. If there is not a true belief in the district that technology is a priority in the curriculum, this belief will be revealed in the budget. Since 1980, if a public school district budget has not been revised and dollars directed to integrating technology (training, equipment, support) into the classroom AND if that change is not glaringly apparent to even the untrained eye, then the patrons of the district should be yelling for accountability. Based on personal experiences over the past 18 years of leading school districts, the technology budget with the general fund should be about 7 to 10% of the total annual budget AND there should be other funding areas to access for the purchasing of computers and technology other than the 7 to 10%. This is a weighty issue when understanding all the needs considered in the public school district budget—but again, the need for graduating technically literate students is also critical.

When organizing a technology committee within a school district, it is important to make a gallant effort to include members that are not connected to the district or employed by it. In any small community, there will be a recognized computer expert that should have input into how a good technology program is developed. Also, most public school districts in America are supported by special education cooperative units or service units of some type; the technical director from this agency should be invited to be a member of the local committee. Before the technology committee makes any decisions, the following process is suggested to be adopted:

- there must be some time devoted to research—to discover how technology is being applied in the business world and to learn about applications in other districts across the nation
- the committee should then develop a vision statement for the district to use in implementing technology—this statement is crucial to the district since all purchasing and budgeting activities would be based on this vision (make sure the Board approves the vision along with dispersing the vision to the staff)
- the district budget should be reviewed as part of the committee's work to help the administration in revamping how the dollars are directed
- from the vision statement, district goals should be created to assist the district in reaching the vision
- the committee should offer some guidance on a district networking plan pertaining to topography and type of equipment

- a purchasing plan should be developed
- a district-wide implementation plan with a timeline for the infusion of technology K-12
- thought should be given to when computers need to be replaced and older machines should be used within the system but in lower volume areas
- a technology support plan (labor and staff development) should be devised and recommended to the board for adoption
- website development should be considered as an educational tool for the students—not just as a way to say 'hello' to web-cruisers
- a K-12 computer curriculum should be drafted; not a complete one, since it would only be used as a guide, but even though computers are used in every classroom, it cannot be assumed that every student is an adept user
- committee time should also be dispensed for identifying outside helping resources for the district in implementing the new vision

As recently as 5 years ago, the organization of a technology committee had only to be a once every 5 year activity. Today, due to the fast pace of technology discovery and improvement in performance, the technology committee should convene every two years with 'briefing' meetings between the two years to keep the members current on research and happenings within the district.

As was stated in the beginning of this report, it is more difficult for rural schools to implement technology into the curriculum than it is for urban districts due to a lack of human, corporate, and financial resources. However, being more difficult doesn't mean that it is an insurmountable process. If a rural district can focus the efforts of many leaders in the community, whether they be farmers, retail dealers, or faculty and staff, advancements can be made that will be impressive to the most advanced district. There is an enormous sense of pride in small communities and if that pride can be channeled in the right direction, the students will not be lacking in any technical preparation. The main problem for rural districts to hurdle in the infusion of technology is giving in to excuses or blaming the budget. These excuses are not acceptable when realizing how giving in to them results in having graduates that will forever be behind in the technology world they will be entering.

The reward for all the problems of finally instituting a quality technology service in the school is the benefit to the children. Once they complete this high school program, an administrator can feel confident that any graduate will be able to compete in a technical world—and not be at a disadvantage coming from a rural district.

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BIOGRAPHY

Dr. Dennis Jensen has been the superintendent of three rural districts, two in South Dakota, and one in Nebraska. He began his first superintendency at the age of 26 and after 18 years in the position, is now in private business in the area of technology and distance education.

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